

## Assessment of land utilization pattern and livestock status in Himachal Pradesh, northwestern Himalaya

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### ABSTRACT

The present study was carried out in different agro-climatic zones of Himachal Pradesh with the objective to assess land utilization pattern and livestock status. In the present study, maximum average landholding of 4.832 ha per household was recorded at Banalgi (Solan) in zone II in medium farmer category. Maximum agricultural landholding of 1.52 ha per household was recorded at Muling (Lahaul and Spiti) in zone IV in medium category, horticultural landholding of 1.291 ha at Kundi (Chamba) in zone III in medium category and silvi-pastoral landholding of 2.91 ha per household at Banalgi (Solan) in zone II in medium farmer category. Maximum average livestock per household (14.77) was recorded at Roghi (Kinnaur) in zone-IV in marginal farmer category. In all agro-climatic zones, marginal farmers possessed highest number of animals. Traditional milking was followed by all the households and no one followed mechanical milking. Majority applied foot and mouth disease vaccination. In vitro fertilization and traditional breeding methods were found in different zones. Farmers mainly used farmyard manure for crop production but in some cases, they used FYM for crop production as well as fuel purpose.

**Keywords:** Land utilization; silvi-pastoral system; livestock; farmers; agroforestry

### INTRODUCTION

In India, currently continuous increase in livestock and human population is putting huge pressure on natural resources and it is also leading to many natural calamities. Presently, India is the world's largest milk producer country but due to fodder scarcity the animal productivity is very low in comparison to global average (Vijay et al 2018). Therefore, agroforestry practices are only sustainable option for fulfilling daily livelihood needs of ever-increasing population without deteriorating existing natural resources. Agroforestry is a land use system that integrates trees, crops and animals in scientific, ecologically desirable, practically feasible and socially acceptable way and provides multiple benefits to the farmers (Nair 1979).

Due to ease in availability, tribal and rural communities in India are highly dependent on agroforestry land use systems for getting their daily needs viz food, fodder, fiber, fuel, timber, manure,

medicines etc. Agri-silviculture, horti-silviculture, horti-silvi-agriculture, agri-horti-silviculture, agri-horticulture, silvi-horticulture, horti-pastoral and silvi-pastoral systems are diversified land use options for agroforestry in the Indian Himalayan region (Kumar et al 2018). Silvo-pastoral systems are agroforestry system type that purposely combine fodder plants for livestock food, nutritional requirement and other interrelated uses (Murgueitio et al 2011). These systems benefit society by contributing in nutrient recycling, water conservation, soil conservation, improving ecosystems through increasing above ground and below ground carbon stock and mitigation of climate change (Sharma et al 2007).

About 99.1 per cent of the livestock population in Himachal Pradesh is reared in rural areas (Sharma et al 2022). There is a shortage of as much as 59 per cent of dry fodder and 37 per cent of green fodder in Himachal Pradesh (Vashist and Pathania 2001). Along with this, indigenous cattle population is also declining

due to adoption of exotic breeds and their crossbreds, reduction in pasture lands and forest grazing rights, disinterest of new generation in traditional nomadism, disease outbreaks, calamities and trampling during migration (Dogra et al 2018). In Himachal Pradesh, landholdings are small and scattered and majority of people fall in marginal category. The major reasons of the poor economic status of people are land degradation, continuously declining productivity of the forests and agro-ecosystem, acute shortage of water and lack of infrastructure development (Sharma et al 2021).

The practice of pure agriculture in Himachal Pradesh is sufficient for the inhabitants to sustain only their food requirements but, for other needs like fodder, fuel, timber etc, people are compelled to exploit natural forests. Thus silvi-pastoral systems are the only viable options for obtaining higher biomass (Dev et al 2014), improvement of soil properties (Nair et al 2007), regulation of the hydrological cycle by reducing runoff intensity (Jose 2009), getting higher biodiversity (Montoya-Molina et al 2016) and improving animal productivity (Broom et al 2013).

The prosperity of people living in hilly areas has traditionally been dependent on the forests, farming, agroforestry and livestock. In the hilly areas, various fodder, fuelwood and timber trees are deliberately retained on bunds of agricultural fields by the farmers for fulfilling their daily livelihood needs and the species composition varies depending on farmers' social status (Seabrook et al 2008). The social factors also play an important role in land use management decisions (Nair et al 2010). Recently, throughout the world, farmers have become interested to manage trees in pasture because of their value in providing fodder/feed of a high nutritive value especially during the dry seasons and because of their economic value as timber, carbon sequestration and conservation of biodiversity (Harvey and Haber 1999, de Abreu et al 2000).

The present study was conducted to assess the land utilization pattern and livestock status in all the agro-climatic zones of Himachal Pradesh.

## METHODOLOGY

The study was carried out during 2019-2021 in Himachal Pradesh and multi-stage stratified random sampling was done to select representative villages. Twelve villages viz Jogipanga (Una), Masiyana (Hamirpur), Bhakra (Bilaspur) and Shiun Khas

(Kangra) of zone I; Naun (Mandi), Banalgi (Solan) and Keela Kalanj (Sirmour) of zone II; Ghiaghi (Kullu), Jarashi (Shimla) and Kundi (Chamba) of zone III and Roghi (Kinnaur) and Muling (Lahaul and Spiti) of zone IV, representing all twelve districts and agroclimatic zones, were selected after discussions with forest officials of respective districts.

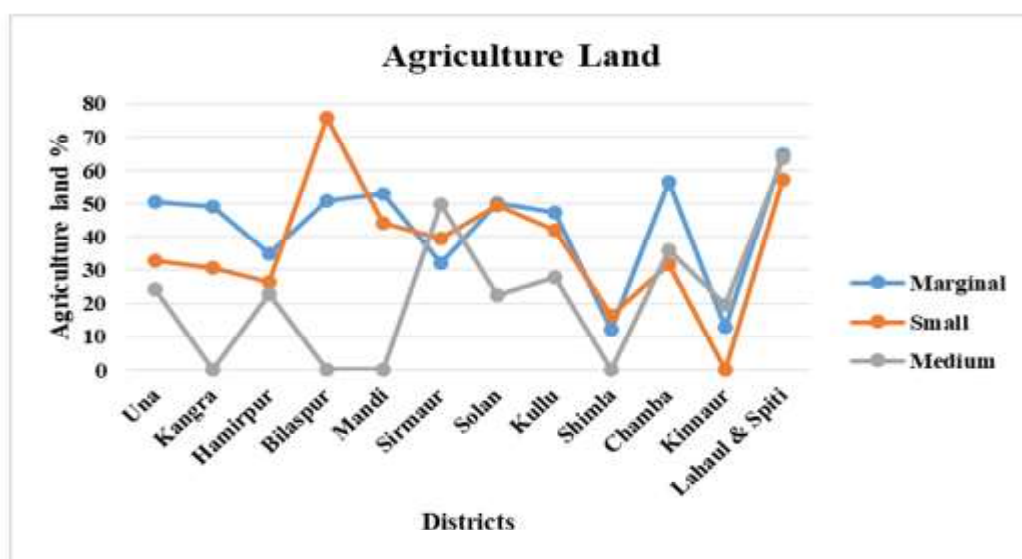
One village was selected randomly from each district representing all the four zones. Total 152, 118, 71 and 50 households were selected from zone I, zone II, zone III and zone IV respectively making a total sample size of 391 households. In each village, farmers were classified on the basis of landholding viz marginal (<1 ha), small (1-2 ha) and medium (2-5 ha) as per the classification of government of Himachal Pradesh. Information on land utilization pattern, livestock status and animal husbandry practices followed was also collected from the selected households through pre-tested, open-ended semi-structured questionnaire and field visits. The data were converted to simple percentages for analysis.

## RESULTS and DISCUSSION

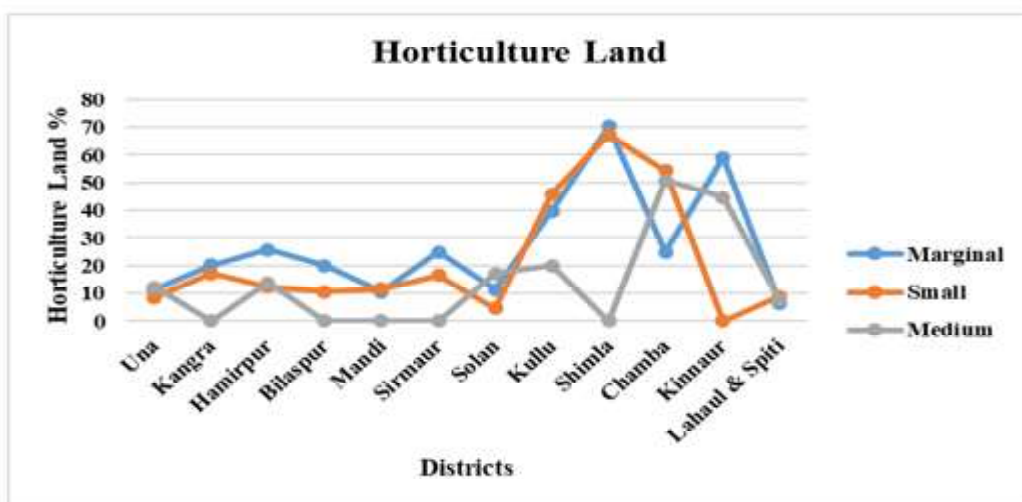
**Land utilization pattern:** Maximum average landholding of 4.832 ha per household was recorded at Banalgi (Solan) in zone II in medium farmer category followed by 2.916 ha per household at Keela Kalanj (Sirmour) in zone II in medium farmer category. However, minimum average landholding of 0.306 ha per household was recorded at Shiun Khas (Kangra) in zone I in marginal farmer category followed by 0.323 ha per household at Naun (Mandi) in zone II in marginal farmer category.

Maximum agricultural landholding of 1.52 ha per household was recorded at Muling (Lahaul and Spiti) in zone IV in medium category followed by 1.458 ha per household at Keela Kalanj (Sirmour) in zone II in medium category. Minimum agricultural landholding of 0.0416 ha per household was observed at Jarashi (Shimla) in zone III in marginal category followed by 0.060 ha per household at Roghi (Kinnaur) in zone I in marginal category (Fig 1A).

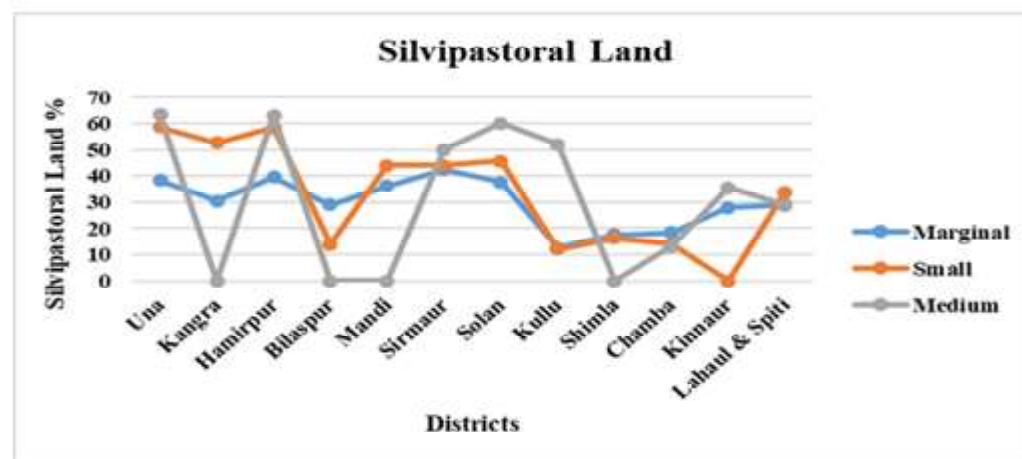
Maximum average horticultural landholding of 1.291 ha was recorded at Kundi (Chamba) in zone III in medium category followed by 0.796 ha at Roghi (Kinnaur) in Zone IV in medium category. Minimum average horticultural land of 0.034 ha each per household was found at Naun (Mandi) in zone II in



A



B



C

Data represents actual situation of selected villages only

**Fig 1. Land utilization pattern in different agro-climatic zones of Himachal Pradesh, A: Agricultural land, B: Horticultural land, C: Silvi-pastoral land**

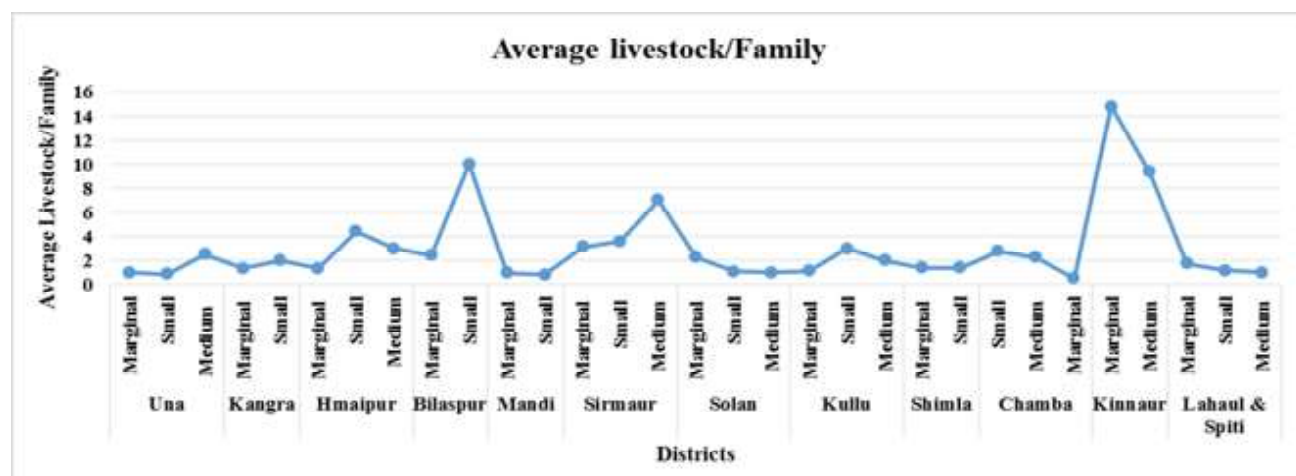


Fig 2. Livestock status in various categories of farmers in different agro-climatic zones of Himachal Pradesh

marginal category and Muling (Lahaul and Spiti) in zone IV in marginal category followed by 0.036 ha per household at Banalgi (Solan) in zone II in marginal category (Fig 1B).

Maximum silvi-pastoral landholding of 2.91 ha per household was recorded at Banalgi (Solan) in zone II in medium farmer category followed by 1.458 ha per household at Keela Kalanj (Sirmaur) in zone II in medium category. However, minimum silvi-pastoral landholding of 0.051 ha per household was recorded at Ghiaghi (Kullu) in zone III in marginal farmer category followed by 0.060 ha at Jarashi (Shimla) in zone III in marginal farmer category (Fig 1C).

**Livestock status:** The data presented in Fig 2 show that maximum average livestock per household (14.77) was recorded at Roghi (Kinnaur) in zone-IV in marginal farmer category followed by 10.0 per household at Bakhra (Bilaspur) in small farmer category. Minimum average livestock per household (0.5) was recorded at Kundi (Chamba) in zone-III in medium farmer category followed by 0.82 per household at Naun (Mandi) in zone-II in small farmer category.

**Animal husbandry practices followed:** The data presented in Table 1 show that in all agro-climatic zones, marginal farmers possessed highest number of animals. In zone I, marginal farmers at Jogipanga (Una), Shiun Khas (Kangra), Masiyana (Hamirpur) and Bhakra (Bilaspur) possessed 95.56, 89.24, 100.00 and 94.44 per cent animals respectively. Similarly, in zone II, they possessed 94.12, 100.00 and 91.67 animals at Naun (Mandi), Keela Kalanj (Sirmaur) and Banalgi (Solan) respectively. In zone III, marginal farmers at Ghiaghi

(Kullu), Jarashi (Shimla) and Kundi (Chamba) possessed 94.12, 87.50 and 100.00 per cent animals respectively. In zone IV, they possessed 100.00 and 83.33 per cent animals at Roghi (Kinnaur) and Muling (Lahaul and Spiti) respectively.

In all the four zones, traditional milking was followed by all the households and no one followed mechanical milking.

Out of the total animals possessed, 58.14, 64.00, 50.00 and 47.06 per cent marginal farmers at Jogipanga (Una), Shiun Khas (Kangra), Masiyana (Hamirpur) and Bhakra (Bilaspur) respectively in zone I; 53.13, 57.89 and 9.09 per cent marginal farmers at Naun (Mandi), Keela Kalanj (Sirmaur) and Banalgi (Solan) respectively in zone II; 50.00, 42.86 and 11.11 per cent at Ghiaghi (Kullu), Jarashi (Shimla) and Kundi (Chamba) respectively in zone III and 22.22 and 33.33 per cent at Roghi (Kinnaur) and Muling (Lahaul and Spiti) respectively in zone IV applied foot and mouth disease vaccination. Deworming was not followed by the farmers.

In zone I, at Jogipanga (Una), Shiun Khas (Kangra), Masiyana (Hamirpur) and Bhakra (Bilaspur), maximum number of marginal farmers (60.47, 48.00, 75.00 and 58.82% respectively) followed in vitro fertilization. In zone II, maximum number of marginal farmers (37.50, 52.63 and 59.09%) at Naun (Mandi), Keela Kalanj (Sirmaur) and Banalgi (Solan) respectively followed in vitro fertilization. In zone III, maximum 50.00, 76.19 and 77.78 per cent marginal farmers at Ghiaghi (Kullu), Jarashi (Shimla) and Kundi (Chamba) respectively followed in vitro fertilization.

In zone IV, at Roghi (Kinnaur) and Muling (Lahaul and Spiti), 77.78 and 46.67 per cent of them respectively followed in vitro fertilization.

Maximum number of marginal farmers (69.77, 80.00, 62.50 and 58.82%) at Jogipanga (Una), Shiun

Khas (Kangra), Masiyana (Hamirpur) and Bhakra (Bilaspur) respectively in Zone I used farmyard manure (FYM) for crop production. However, in zone II, at Naun (Mandi), Keela Kalanj (Sirmaur) and Banalgi (Solan), maximum number of marginal farmers (59.38, 78.95 and 72.73% respectively) used FYM for crop

Table 1. Animal husbandry practices followed by various categories of farmers in different agro-climatic zones of Himachal Pradesh

| Agro-climatic zone | Area/district           | Farmers' category | Total number of farmers (a) | Number of farmers possessing animals (b) | Milking procedure |                 | Disease management |                     |
|--------------------|-------------------------|-------------------|-----------------------------|------------------------------------------|-------------------|-----------------|--------------------|---------------------|
|                    |                         |                   |                             |                                          | Mechanical (c)    | Traditional (d) | Deworming (e)      | FMD vaccination (f) |
| Zone-I             | Jogipanga (Una)         | Marginal          | 45                          | 43(95.56)                                | -                 | 43              | -                  | 25(58.14)           |
|                    |                         | Small             | 08                          | 8(100.00)                                | -                 | 8               | -                  | 4(50.00)            |
|                    |                         | Medium            | 02                          | 2(100.00)                                | -                 | 2               | -                  | 2(100.00)           |
|                    | Shiun Khas (Kangra)     | Marginal          | 28                          | 25(89.29)                                | -                 | 25              | -                  | 16(64.00)           |
|                    |                         | Small             | 04                          | 3(75.00)                                 | -                 | 3               | -                  | 2(66.67)            |
|                    |                         | Medium            | 0                           | 0                                        | -                 | -               | -                  | -                   |
|                    | Masiyana (Hamirpur)     | Marginal          | 40                          | 40(100.00)                               | -                 | 40              | -                  | 20(50.00)           |
|                    |                         | Small             | 4                           | 3 (75.00)                                | -                 | 3               | -                  | 1(33.33)            |
|                    |                         | Medium            | 1                           | 1 (100.00)                               | -                 | 1               | -                  | 1(100.00)           |
|                    | Bhakra (Bilaspur)       | Marginal          | 18                          | 17(94.44)                                | -                 | 17              | -                  | 8(47.06)            |
| Small              |                         | 2                 | 1(50.00)                    | -                                        | 1                 | -               | -                  |                     |
| Medium             |                         | 0                 | 0                           | -                                        | 0                 | -               | -                  |                     |
| Zone-II            | Naun (Mandi)            | Marginal          | 34                          | 32(94.12)                                | -                 | 32              | -                  | 17(53.13)           |
|                    |                         | Small             | 17                          | 15(88.24)                                | -                 | 15              | -                  | 9(60.00)            |
|                    |                         | Medium            | 0                           | 0                                        | -                 | 0               | -                  | -                   |
|                    | Keela Kalanj (Sirmaur)  | Marginal          | 19                          | 19(100.00)                               | -                 | 19              | -                  | 11(57.89)           |
|                    |                         | Small             | 5                           | 4(80.00)                                 | -                 | 4               | -                  | -                   |
|                    |                         | Medium            | 1                           | 1(100.00)                                | -                 | 1               | -                  | -                   |
|                    | Banalgi (Solan)         | Marginal          | 24                          | 22(91.67)                                | -                 | 22              | -                  | 2(9.09)             |
|                    |                         | Small             | 16                          | 13(81.25)                                | -                 | 13              | -                  | 6(46.15)            |
|                    |                         | Medium            | 2                           | 2(100.00)                                | -                 | 2               | -                  | 1(50.00)            |
|                    | Zone-III                | Ghiahgi (Kullu)   | Marginal                    | 17                                       | 16(94.10)         | -               | 16                 | -                   |
| Small              |                         |                   | 3                           | 3(100.00)                                | -                 | 3               | -                  | -                   |
| Medium             |                         |                   | 1                           | 1(100.00)                                | -                 | 1               | -                  | -                   |
| Jarashi (Shimla)   |                         | Marginal          | 24                          | 21(87.50)                                | -                 | 21              | -                  | 9(42.86)            |
|                    |                         | Small             | 11                          | 7(63.64)                                 | -                 | 7               | -                  | -                   |
|                    |                         | Medium            | -                           | -                                        | -                 | -               | -                  | -                   |
| Kundi (Chamba)     |                         | Marginal          | 9                           | 9(100.00)                                | -                 | 9               | -                  | 1(11.11)            |
|                    |                         | Small             | 4                           | 4(100.00)                                | -                 | 4               | -                  | 1(25.00)            |
|                    |                         | Medium            | 2                           | 2(100.00)                                | -                 | 2               | -                  | -                   |
| Zone-IV            |                         | Roghi (Kinnaur)   | Marginal                    | 9                                        | 9(100).00         | -               | 9                  | -                   |
|                    | Small                   |                   | 0                           | 0                                        | -                 | 0               | -                  | -                   |
|                    | Medium                  |                   | 5                           | 5(100.00)                                | -                 | 5               | -                  | 1(20.00)            |
|                    | Muling (Lahaul & Spiti) | Marginal          | 18                          | 15(83.33)                                | -                 | 15              | -                  | 5(33.33)            |
|                    |                         | Small             | 16                          | 12(75.00)                                | -                 | 12              | -                  | 5(41.67)            |
|                    |                         | Medium            | 2                           | 2(100.00)                                | -                 | 2               | -                  | -                   |

b): Figures in parentheses are per cent values over (a), f): Figures in parentheses are per cent values over (b); FMD: Foot and mouth disease

Table 1. Contd.....

| Agro-climatic zone | Area/district           | Farmers' category | Total number of farmers | Breeding method |             |           | FYM usage       |                                |
|--------------------|-------------------------|-------------------|-------------------------|-----------------|-------------|-----------|-----------------|--------------------------------|
|                    |                         |                   |                         | IVF             | Traditional | Both      | Crop production | Crop production + fuel purpose |
|                    |                         |                   |                         | (g)             | (h)         | (i)       | (j)             | (k)                            |
| Zone-I             | Jogipanga (Una)         | Marginal          | 45                      | 26(60.47)       | 7(16.28)    | 10(23.26) | 30(69.77)       | 13(30.23)                      |
|                    |                         | Small             | 08                      | 4(50.00)        | 2(25.00)    | 2(25.00)  | 6(75.00)        | 2(25.00)                       |
|                    |                         | Medium            | 02                      | 2(100.00)       | -           | -         | 2(100.00)       | -                              |
|                    | Shiun Khas (Kangra)     | Marginal          | 28                      | 12(48.00)       | 8(32.00)    | 5(20.00)  | 20(80.00)       | 5(20.00)                       |
|                    |                         | Small             | 04                      | 2(66.67)        | -           | 1(33.33)  | 2(66.67)        | 1(33.33)                       |
|                    |                         | Medium            | 0                       | -               | -           | -         | -               | -                              |
|                    | Masiyana (Hamirpur)     | Marginal          | 40                      | 30(75.00)       | 5(12.50)    | 5(12.50)  | 25(62.50)       | 15(37.50)                      |
|                    |                         | Small             | 4                       | 3(100.00)       | -           | -         | -               | 3(100.00)                      |
|                    |                         | Medium            | 1                       | 1(100.00)       | -           | -         | -               | 1(100.00)                      |
|                    | Bhakra (Bilaspur)       | Marginal          | 18                      | 10(58.82)       | 5(29.41)    | 2(11.76)  | 10(58.82)       | 7(41.76)                       |
|                    |                         | Small             | 2                       | 1(100.00)       | -           | -         | -               | 1(100.00)                      |
|                    |                         | Medium            | 0                       | -               | -           | -         | -               | -                              |
| Zone-II            | Naun (Mandi)            | Marginal          | 34                      | 12(37.50)       | 9(28.13)    | 11(34.38) | 13(40.63)       | 19(59.38)                      |
|                    |                         | Small             | 17                      | 6(40.00)        | 4(26.67)    | 5(33.33)  | 10(66.67)       | 5(33.33)                       |
|                    |                         | Medium            | 0                       | -               | -           | -         | -               | -                              |
|                    | Keela Kalanj (Sirmaur)  | Marginal          | 19                      | 10(52.63)       | 6(31.58)    | 3(15.79)  | 4(21.05)        | 15(78.95)                      |
|                    |                         | Small             | 5                       | 3(75.00)        | -           | 1(25.00)  | -               | 4(100.00)                      |
|                    |                         | Medium            | 1                       | 1(100.00)       | -           | -         | -               | 1(100.00)                      |
|                    | Banalgi (Solan)         | Marginal          | 24                      | 13(59.09)       | 6(27.27)    | 3(13.64)  | 6(27.27)        | 16(72.73)                      |
|                    |                         | Small             | 16                      | 6(46.15)        | 4(30.76)    | 3(23.08)  | -               | 13(100.00)                     |
|                    |                         | Medium            | 2                       | 2(100.00)       | -           | -         | -               | 2(100.00)                      |
| Zone-III           | Ghiahgi (Kullu)         | Marginal          | 17                      | 8(50.00)        | 5(31.25)    | 3(18.75)  | 16(100.00)      | -                              |
|                    |                         | Small             | 3                       | 3(100.00)       | -           | -         | 3(100.00)       | -                              |
|                    |                         | Medium            | 1                       | 1(100.00)       | -           | -         | 1(100.00)       | -                              |
|                    | Jarashi (Shimla)        | Marginal          | 24                      | 16(76.19)       | 2(9.52)     | 3(14.29)  | 21(100.00)      | -                              |
|                    |                         | Small             | 11                      | 5(71.43)        | -           | 2(28.57)  | 7(100.00)       | -                              |
|                    |                         | Medium            | -                       | -               | -           | -         | -               | -                              |
|                    | Kundi (Chamba)          | Marginal          | 9                       | 7(77.78)        | -           | 2(22.22)  | 4(44.44)        | 5(55.56)                       |
|                    |                         | Small             | 4                       | 3(75.00)        | 1(25.00)    | -         | 4(100.00)       | -                              |
|                    |                         | Medium            | 2                       | -               | -           | 2(100.00) | -               | 2(100.00)                      |
| Zone-IV            | Roghi (Kinnaur)         | Marginal          | 9                       | 7(77.78)        | -           | 2(22.22)  | 9(100.00)       | -                              |
|                    |                         | Small             | 0                       | -               | -           | -         | -               | -                              |
|                    |                         | Medium            | 5                       | 3(60.00)        | -           | 2(40.00)  | 5(100.00)       | -                              |
|                    | Muling (Lahaul & Spiti) | Marginal          | 18                      | 7(46.67)        | 2(13.33)    | 6(40.00)  | 13(86.67)       | 2(13.33)                       |
|                    |                         | Small             | 16                      | 6(50.00)        | 1(8.33)     | 5(41.67)  | 12(100.00)      | -                              |
|                    |                         | Medium            | 2                       | 2(100.00)       | -           | -         | 2(100.00)       | -                              |

h), i), j), k) and l): Figures in parentheses are per cent values over (b); FYM: Farmyard manure, IVF: In vitro fertilization

production as well as fuel purpose. In zone III, at Ghihagi (Kullu) and Jarashi (Shimla), all the farmers, irrespective of farmer category, used FYM only for crop production, whereas, at Kundi higher number of marginal farmers (55.56%) used FYM for crop production as well as fuel purpose. In zone IV, at Roghi (Kinnaur), all the farmers and at Muling (Lahaul and

Spiti), 86.67 per cent marginal farmers used FYM for crop production.

Bains and Atlas (2022) reported that agriculture is the main occupation of the people of Himachal Pradesh. It provides direct employment to about 69.00 per cent of the total workers of the state.

Out of the total geographical area of 55.67 lakh hectares, the area of operational holdings is about 9.68 lakh hectares and is operated by 8.53 lakh farmers. The average holding is 1.04 hectare. According to 2011-12 agriculture census, 87.00 per cent of the total operational holdings are of marginal and small farmers, and about 12.60 per cent of holdings are owned by semi-medium and medium farmers and only 0.4 per cent by large farmers.

Sharma et al (2022) reported that the total livestock population in Himachal Pradesh was recorded as 5.22 million in 1997, which fell to 4.41 million in 2019 signifying negative growth rate of 15.53 per cent in the specified period. The decreasing livestock population in the state is a matter of concern for policy makers as it signifies that farmers in the state were abandoning the livestock rearing due to various reasons like fragmentation of landholdings, nuclear families, preference towards tertiary jobs, scarcity of feed and fodder etc.

### CONCLUSION

India with a large population has always been anxious about food security for its inhabitants. Besides basic needs of food, the requirement of forest products especially fodder, fuelwood and timber have equal importance. With tremendous increase in human population, pressure on natural forests for fuel, fodder, timber etc has increased considerably and this has led to a huge gap between demand and supply of many forest products.

The present study revealed that all the four zones of Himachal Pradesh were dominated by marginal farmers and they also possessed highest number of animals. In agroclimatic zones I, II and IV, agricultural and silvi-pastoral were major land use systems. However, in zone III, horticulture and agriculture were major land use systems.

Traditional milking was followed by all the households and no one followed mechanical milking. Majority applied foot and mouth disease vaccination. In vitro fertilization and traditional breeding methods were found in different zones. Farmers mainly used farmyard manure for crop production but in some cases, they used FYM for crop production as well as fuel purpose.

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